

phyta; (iv) Phaeophyta; (v) Rhodophyta; (vi) Euthallophyta; and (vii) Cormophyta; and he thinks it very probable that the Cormophytes may have been derived from one or the other of these stems, most probably from the Euthallophyta. The designation of these stems are mostly sufficiently descriptive to be intelligible; but one is naturally curious as to what the Euthallophyta include, as they are here placed next to the Cormophyta, on account "of possible genetic connections." Wettstein's brief diagnosis of this group runs:—

"One-celled or many-celled. Cells of the vegetative stages of development, clothed by a membrane, which is not composed of shell-like segments. Autotrophic (self-nourishing) or (in derived series of forms) heterotrophic. The autotrophic forms always furnished with chlorophyll in the assimilating cells. Simpler forms propagated vegetatively only; those of higher organisation sexually as well. Autotrophic forms (with isolated exceptions) adapted to the development of their reproductive organs in water. Not differentiated into root, stem, and leaf."

It is not assumed that the above characteristics (all or any one of them) are peculiar to the group; but as thus broadly defined, the Euthallophyta include two classes, the Chlorophyceæ and the Fungi. To the first belong the orders Volvoceæ, Ulothricaceæ, Siphonaceæ, and the Characeæ. The Fungi are divided into parasitic and saprophytic Fungi, including those symbiotic with Cormophytes (Mycorrhiza, &c.), and Fungi symbiotic with Algæ, otherwise Lichens. The Myxophyta, formerly associated with Fungi, and now placed in the lowest series of vegetable organisms, are characterised thus:—

"One-celled or many-celled. Vegetative stages of development composed entirely of membraneless cells. Nourishment never autotrophic. Sexual reproduction altogether wanting."

We have not space to enlarge on the treatment of the different groups of organisms; but it may be mentioned that the Schizomycetes (bacteria) are described and illustrated in some detail, though the figures are practically all copied from Migula, Meyer, and other writers on the subject, and are much the same as in the first edition.

It may be interesting to mention that the cells of some of the Schizomycetes are the smallest hitherto measured; those of *Spirillum parrum* being from 0.1 to 0.3 μ in thickness, whilst those of the organism causing lung-disease in cattle are described as even smaller.

Turning to the Gymnospermæ. It seems a pity that the term "flower" should still be employed to designate the organs of reproduction, with or without envelopes or appendages, especially as the interpretations of authors are so divergent; some viewing the female cone of an Abies, for example, as an inflorescence, others as a flower. Much confusion has arisen from this cause in the nomenclature of the components of a cone. Wettstein defines the flowers, "characteristic of all Anthophytes," as shoots, or parts of shoots, which bear the leaves on which the sexual organs of reproduction are formed. And he adds that accepting this

definition, Selaginella is the only other genus among recent plants that has flowers. In this connection it may be added that the fossil Bennettitinae present some of the most singular of the "flowers" of Gymnosperms. They are either unisexual or bisexual. Those of *Cycadeoidea ingens* are interpreted as having a perianth of numerous plumose segments; twelve pinnate stamens, involute in æstivation, with very numerous anther-cells, and a solitary central gynæceum or ovule, whereas *C. Wielandii* has female "flowers" with a plumose perianth and numerous separate ovules, or gynæcia, looking much more like pistils.

Tumboa (Welwitschia) is mentioned as the only living gymnosperm in which the pollen is conveyed by insects to the ovules.

The foregoing was written before the second part of the work was received. This has undergone less modification than the first, and we must dismiss it with a few words. We note that the proposed new Order or Family, the Julianiaceæ, has been accepted and placed in the Juglandales, though Hallier had previously reduced it to the Terebinthaceæ. The entire work has undergone an enlargement from 778 pages to 914, with 571 additional figures. Most of the figures are exceedingly good, but unfortunately many of them have lost much of their beauty through being printed too black. Of course, in a comprehensive work like the present, a large proportion of the figures must be borrowed; but here the source of every one is indicated. It may be added that Dr. Wettstein writes a simple, clear German which is easily construed.

W. B. H.

PHOTOMICROGRAPHY.

Practical Photomicrography. By J. E. Barnard. Pp. xii+322+10 plates. (London: Edward Arnold, 1911.) Price 15s. net.

KING SOLOMON'S remark that "of making books there is no end," applies to the subject of Photomicrography nowadays, as well as to any subject in his time, for many indeed are the books, both large and small, that are now available. Yet the author of "Practical Photomicrography" has had the courage to publish a handsome volume of some 300 pages which we think fills a unique place. Our reason for saying so is because we should call this book a dictionary upon the subject rather than a practical guide, and there is no such work as that in existence. For example, if we require an illuminant suitable for some special class of work, we have only to turn to our dictionary, open the chapter devoted to "sources of illumination," and there we find an epitome of all that is known upon the subject. So, too, with cameras for all classes of work, photographic stands, and, indeed, every other thing connected with photomicrography. But if we look for practical hints or useful "dodges," such as the author must know in abundance, we can find—if, indeed, any at all—only a very meagre supply. There is no taking the beginner by the hand when attempting his first photograph, and telling him how

to proceed to obtain a uniform background, and how to adapt and regulate his screen or filter so as to increase or diminish contrast; no explaining to him such things as how to distinguish between the use of an ordinary inch on his microscope, and the employment of a planar or such-like combination of the same magnifying power; no helping him to make progress from low-power work to high-power magnifications, and the pointing out to him the many pitfalls he may expect in this section of the work. Nothing, or very little indeed of this nature is given; anyhow, in a collective and succinct form.

Proceeding seriatim through the book, the introduction over, the reader is told first about the microscope and general equipment, not so much in particular for any special type of work—such as high, low, or medium magnifications, but in a general way; and tables of magnification, cuts of different eye-pieces and such-like, occupy several pages. It must not be omitted to mention some good photographs of Abbe's test-plate, but we question the expediency of comparing the photographic performance of achromats with that of apochromats, unless the former are used in conjunction with a suitable screen to cut off the secondary spectrum, which we are unable to find was done in this instance. A student upon seeing these comparisons might be led to think that the achromat was of no service at all, whereas the image in the preferred colour with most of the newer form of modern achromats is of the finest description, and almost rivals that produced by the apochromat: but a screen *must* be used.

Whilst referring to the resolution possessed by combinations of different numerical aperture, an error has crept in on p. 60. The 80,000 should be 40,000, as a solid direct cone is being spoken about, and not oblique light. Abbe's law of *doubling* the number of waves to the inch of the light employed refers only to the use of oblique pencils, and not to direct illumination at all. Passing over this slip in the reading of the proofs, we come to the consideration of collecting systems, and here again we find a most comprehensive chapter full of interest and information; but we must remind the reader that the Köhler lenses are not of the simple kind that the author leads one to believe. A careful examination of their curves reveals at once that they are of what may be called the distorted type. Their originality and usefulness has led the makers to call them after their inventor's name.

The sources of illumination, as we have already said, are fully discussed in the chapter devoted to this branch of the subject, and the dark-room and photographic methods, with all connected with the production of the negative and positive, whether on glass or paper, carefully gone into. The master mind is here very much in evidence, although he offers but scanty information how to distinguish a slightly over-exposed from a slightly under-exposed plate; his opinions would have been welcome we feel sure, even to the experienced hand, for at times it is extremely difficult to decide.

Several methods of reducing vibration with apparatus located in other places than the basement are mentioned, but we did not notice the method of using

several layers of carpet-felt under each leg of the apparatus. We have been told—and it is common knowledge—that several workers in busy streets employ this method—which was suggested by Mr. Norman—with much satisfaction.

A chapter is written upon the manipulation of the apparatus in general, but it is of a scattered nature and not collected under specific heads, so that the reader is left to ferret out what he wants for any special kind of work. The information may be there, but not easy to find.

The use of filters and screens is dealt with, and, so far as it goes, is of great value and information; but it is to be regretted more particular mention is not made of the uses of the box of "gelatines" sold by Messrs. Wratten and Wainwright, of Croydon. In the booklet accompanying the arrangement opposite to the name of most dyes used for microscopy, is placed the number of the screen to be used to increase contrast if required, whilst, in addition, besides showing how to reduce contrast, a table is given showing how by the assembling of certain of the same films together, monochromatic light of given wave-length can be obtained at almost any part of the visible spectrum. It is obvious of what service this little "box" is to the practical man at work, and ought to be always named as part of the equipment.

The description of several special processes, stereoscopic photography, the photographing of culture tubes and cultures, are followed by some important remarks concerning the use of ultra-violet rays; and then comes a very comprehensive index and the plates.

We are bound to express our disappointment at the appearance presented by plate i. Everyone knows it is not altogether easy to obtain a uniformly and pleasantly tinted background, but in this instance the blocks have been cut away up to the very margin of the object, and even that is sliced up into moieties! Surely a student who looks for guidance wants an ideal to live up to, a standard at which to aim? If the teacher be guilty of exhibiting work of this description, how will he teach the tyro to do better? The author's strong point is certainly not that of photographing diatoms, but is rather that dealing with bacteriological specimens and such like. Take, for example, the photograph of *Trypanosoma gambiense*, or that of *Bacillus typhosus*, in plate vii.: we doubt if it be possible to find two more magnificent illustrations in any book upon the subject. So too with the Podura scales in plate viii. The manner in which the constriction around the head of the so-called "comma" or "note" is shown is beyond all praise, and so too is the delicate tapering off to a point of its extreme end: it is perfection. We wonder what the promoters of the new idea that this focus is not the correct one, and that they have found another two or three (according to how they misarrange their adjustments), will say to this magnificent work? Taking "Practical Photomicrography" as a whole, we cordially recommend it, and congratulate the writer; but the reader must approach it as a dictionary full of answers to questions he may desire to put, rather than as a guide, philosopher, and friend, for that it is not.